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**Logistics Innovation and Its Influence on Performance of  
Building and Construction Manufacturing Firms in Kenya**



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## **Logistics Innovation and Its Influence on Performance of Building and Construction Manufacturing Firms in Kenya**

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### **Abstract**

**Purpose:** The study sought to assess the influence of logistics innovation on the performance of building and construction manufacturing companies in Kenya. This comes at a time when the world is facing climatic challenges and dynamics attributed to increased environmentally unfriendly practices which lead to increased emissions and pollution to the environment. As the companies are called to practice eco-friendly operations, logistics remains one area of focus, where most global leaders are investing in to ensure sustainability is embraced. However, this has not been effectively assessed on a local context. The study sought to establish the key logistics innovations that manufacturing companies can embrace to enhance performance.

**Methodology:** The study adopted a descriptive research design approach. This method is preferred because it allows an in-depth study of the subject. The study population was 900 employees drawn from the 54 building and construction manufacturing firms in Kenya. The sample size was 270 respondents which was determined through purposive sampling targeting departments (production, quality assurance, procurement and supply chain, transport and logistics, and administration) in the 54 companies. Primary data was collected using a questionnaire. Quantitative data was analyzed through descriptive statistics and inferential statistics.

**Findings:** The results revealed that logistics innovation significantly influenced the performance of the building and construction manufacturing firms in Kenya. The study

concluded that through embrace of green logistics through logistics innovation, performance of the manufacturing firms was obtained.

**Unique Contribution to Theory, Policy and Practice:** It is recommended that the management of the building and construction manufacturing firms embraces logistics innovation through use of solar technology, hybrid vehicles and tracks and reducing emissions in order to enhance sustainability and promote performance.

**Keywords:** *Green Logistics, Logistics Innovation, Firm Performance, Building and Construction Manufacturing Firms.*

## 1.0 INTRODUCTION

### 1.1 Background of the Study

The study aimed at establishing the influence of logistics innovation on performance of building and construction manufacturing firms in Kenya. Logistics innovation refers to the equipment and logistics of transporting passengers and goods. It covers movement by all forms of transport, from cars and buses to boats, aircraft and even space travel (Gil-Saura & Ruiz-Molina, 2011). The demand for environmentally friendly products has increased over the years and so is the shifting of loyalty of consumers. The ever-increasing costs of energy and inputs have forced business to find new ways to reduce energy use in order to reduce costs (Hausman, Lee & Subramanian, 2013). Supply chain management has been identified to have a significant impact on the natural environment as a result, businesses are deeply trying to green their supply chain by introducing green strategies in their organizations and in the supply chain. This has resulted in a growing need for integrating environmental thinking into supply chain management and processes

According to Closs and Meacham (2011), green logistics management is effective movement of raw and finished products from the supplier to site of construction as well the forward and reverse flow of products and information between the point of origin and the point of consumption whose purpose is to meet or exceed customer demand (Gold & Beske, 2010). Logistics is the term now widely used to describe the transport, storage and handling of products as they move from raw material source, through the production system to their final point of sale or consumption.

Daugherty (2011) explains that logistics innovation seeks to reduce Transport costs and improve delivery times through effective timetabling and route management (Shang & Marlow, 2005). Periodic re-evaluations and the development of alternative routes allow for timely changes to the transportation system in order to maintain efficiency. A hybrid electric vehicle (HEV) is a type of vehicle that uses both an electric engine and a conventional internal combustion engine (Beers, 2014). This type of vehicle is considered to have better performance and fuel economy compared to a conventional one in terms of oil consumption is less than that of conventional vehicles carbon-based emission is lower, which makes HEVs more eco-friendly (Gil-Saura & Ruiz-Molina, 2011). This also helps conserve non-renewable resources like petroleum products. Maintenance costs are lower than those of conventional vehicles. With the electric motor taking charge of the engine during long travels, more mileage can be achieved with HEVs compared to other types of vehicles.

Azizi and Tarhandeh (2014) explain that biofuel is a fuel that is produced through contemporary biological processes, such as agriculture and anaerobic digestion, Biofuels can be derived directly from plants, or indirectly from agricultural, commercial, domestic and industrial wastes (Johnston & Cheng, 2012). A natural gas vehicle (NGV) is an alternative fuel vehicle that uses compressed natural gas (CNG) or liquefied natural gas (LNG). Natural gas vehicles should be different from vehicles powered by LPG mainly propane, which is a fuel with a fundamentally different composition.

Green logistics management are strategies that reduce the environmental and energy footprint of freight distribution, which focuses on material handling, waste management, packaging and transport (Meysam, 2013). Green logistics consists of all activities related to the eco-efficient management of the forward and reverse flows of products and information between the point of origin and the point of consumption whose purpose is to meet or exceed customer demand (Muraguri & Musyimi, 2015).

According to Wedawatta *et al.* (2011), in building and construction, many people are involved in the creation of levels of non-uniformity that is non-existence in the production of the output. An example is the construction company where it becomes difficult to maintain the same performance level as the players in the industry are many. According to Wolf (2014) as global suppliers of manufactured products, manufacturing enterprises in ought to implement sustainable solutions such as green logistics management (GLM) for the movement of the goods both to manufacturing industries and customers. The focus is on profitable growth without inflicting environmental damages through pollution to other countries through managing the logistics cycle of their merchandises spanning sourcing, channel deliveries, general distribution and disposal of the waste and default products (Hsueh, 2015).

The Kenya Association of Manufacturers (2019) classifies companies that deal with the manufacture and production of building and construction materials under building and construction manufacturing companies. The companies deal with products such as cement manufacturing, manufacture of steel and iron, manufacture of paints and assembling of building materials among other products.

## 1.2 Statement of the Problem

A report by KAM (2017) revealed that most of the manufacturing companies in building and construction sector recorded over 15% decline in their annual turnover while the sector lost over 2.8% of its market share between 2013 and 2017. According to the Competition Authority of Kenya (CAK) (2018), building and construction manufacturing companies in Kenya have been facing tough times in the market a matter that has seen most of the companies retrench to save their operational costs. This is despite the continued growth of urban centres and demand for housing and related infrastructure in the country. Kaungeria (2020) notes that the growth in the building and construction manufacturing firms may not replicate the performance of construction manufacturing companies, since the clients and the companies that manufacture the construction materials are two distinct parties. According to KAM (2020), in the period between 2015 and 2019, close to 45% of the building and construction manufacturing firms had recorded over 26% increase in their annual operational costs, with costs related to supply chain and logistics practices taking up to 48% of these costs. The available evidence therefore shows that despite the surge in high-rise buildings and other mega construction projects in the country, the construction and building manufacturing companies have been poorly performing in the recent past.



Green logistics through aspects such as logistics innovation has been considered as a major approach in promoting sustainability of the supply chain management through which organizational performance is enhanced as well as meeting the environment conditions of the modern-day World (UNEP, 2018). Empirical studies have revealed mixed results on the relationship between green logistics and firm performance. Vermeulen (2015) and Qureshi, Rasli and Zaman (2016) found that green logistics through logistics innovation is an aspect of green supply chain that has a significant influence on the firm performance through cost-saving and enhancing efficiency and effectiveness. The evidence shows that little has been done to establish the relationship between green logistics and performance of the sector while the available literature shows conflicting results. It is on this merit that the study seeks to establish the influence of logistics innovation on performance of building and construction manufacturing companies in Kenya.

### **1.3 Objectives of the Study**

To determine the effect of logistics innovation on performance of building and construction manufacturing firms in Kenya.

### **1.4 Research Hypotheses**

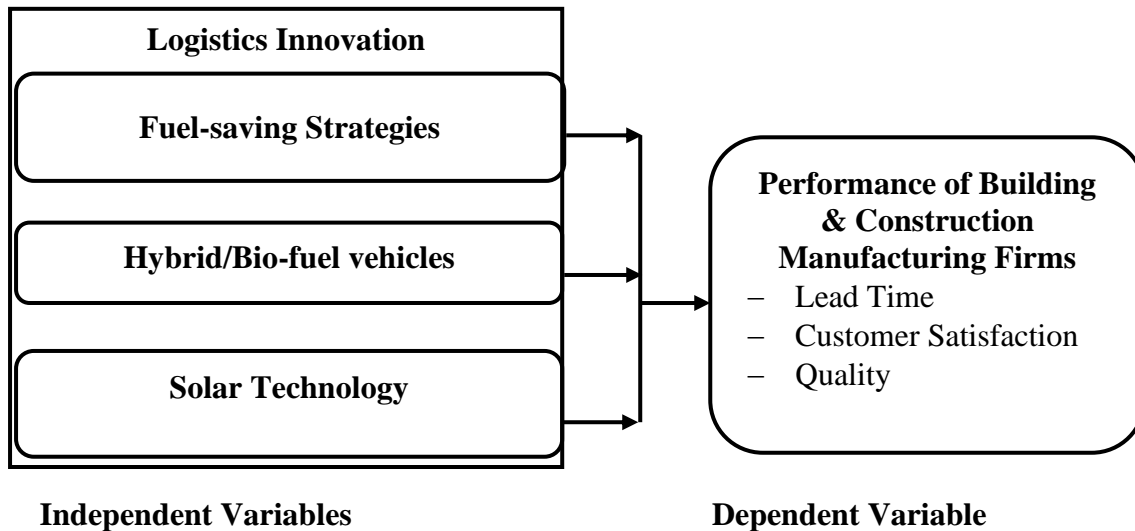
H<sub>a</sub>: Logistics innovation has a significant effect on the performance of building and construction manufacturing firms in Kenya.

## **2.0 LITERATURE REVIEW**

### **2.1 Theoretical Review**

The study was anchored on Technology Acceptance Model (TAM) by Davis (1986). The theory upholds the need for innovation and embrace of technology in key organizational operations including logistics. The reason of TAM is that individuals conduct expectation to acknowledge and really utilize a specific innovation dictated by two builds in particular; saw handiness and saw usability (Davis, 1989). User's frame of mind and conviction as proposed by TAM is seen to be an (Yu & Ramanathan, 2015) where Procurement Information Systems is a business-to-business (B2B) purchasing practice that utilizes electronic procurement to identify potential sources of supply, to purchase goods and services, to transfer payment, and to interact with suppliers. The authors believe that this definition provides the scope to investigate the basic level of procurement information systems in the Irish ICT manufacturing sector (Gupta & Dandekar, 2012). The theory highlights the need for continued innovation and embrace of technology while ensuring that the employees are adequately involved in the technological perspectives of the organization. Through continued logistics innovation, the organization is able to streamline its effectiveness in logistics, save on operational costs while conserving the environment.

## 2.2 Conceptual Framework



**Figure 1: Conceptual Framework**

## 2.3 Empirical Literature Review

Ballot and Fontane (2010) did a study on reducing transportation CO<sub>2</sub> emissions through pooling of supply networks: perspectives from a case study in French retail chains. The study focused on the implementation of green purchasing for accomplishing green logistics management, by the use of supplier integration and supply disruption risk. A survey was conducted on two hundred and seventy-two (272) respondents from supply and purchase managers and the findings supported the positive impact of integration with suppliers on adoption of environmental practices. However, the study showed a negative impact of supply disruption risk on the adoption of environmental practices.

The study found a diverse range of applications in manufacturing, real-time control systems, electronic commerce, network management, logistics innovation, information management, scientific computing, health care, and entertainment. The reason for the growing success of agent technology in these areas is that the inherent distribution allows for a natural decomposition of the system into multiple agents that interact with each other to achieve a desired global goal

Hakimi (2012) studied the environmental and economic issues arising from the pooling of SMEs' supply chains: case study of the food industry in Western France. The logistics innovation is well suited to an agent-based approach because of its geographically distributed nature and its alternating busy-idle operating characteristics from the transportation management perspective, the most appealing characteristics of agents are autonomy, collaboration, and reactivity. Agents can operate without the direct intervention of humans or others. The study found that helps to implement automated traffic control and management systems agents are collaborative. In a multivalent system (MAS), agents communicate with other agents in a system to achieve a global goal.

### 3.0 RESEARCH METHODOLOGY

The study used a cross-sectional research design. This design incorporates collection and analysis of cross-sectional data which according to Kothari (2014); enables intensive collection of in-depth data for the purpose of responding to the research questions.

The target population for the study comprised of the building and construction manufacturing firms registered with under the Kenyan Association of Manufacturers. As of December 2021, there were 54 building and construction manufacturing firms registered under KAM. The firms deal with manufacture of building and construction materials and accessories including cement, glassware, steel and iron materials, precast and ready-mix concrete, and quarry construction and building materials. The study targeted approximately 900 senior management and administrative staff from the 54 companies. All the 54 companies were included in the sample. Using a purposive sampling, 5 key departments were included in the sample giving a sample size of 270 respondents.

This study used primary data which was collected using a structured questionnaire. The questionnaire was administered both manually (physically) and through online means. Descriptive statistics such as frequency distributions and percentages were used to summarize basic features of the data in the study. Inferential statistics were used to test the research hypothesis.

### 4.0 RESEARCH FINDINGS AND DISCUSSIONS

#### 4.1 Response Rate

Out of the 270 issued questionnaires, 228 were dully filled and returned back for analysis. This represented a response rate of 84.4%, which was concluded to be adequate in this study.

#### 4.2 Descriptive Results on Logistics innovation

The study sought to establish the influence of logistics innovation on the performance of building and construction manufacturing firms in Kenya. The logistics innovation was addressed in terms of fuel saving strategies, hybrid or bio-fuel vehicles and use of solar technology. These are the common innovations used to enhance green logistics. The respondents were asked to indicate their level of agreement or disagreement on specific statements drawn from these aspects based on a 5-points Likert's scale. Table 1 summarizes the findings. The findings compare with those by Hsueh (2015) who established that most of the firms in building and construction manufacturing firms fail to consider roper innovations in green logistics thus they do not save on costs of production. Jaafar and Tajuddin (2016) allude that as a result of low adoption of innovativeness in logistics, companies spend more to transport their goods thus recording declined performance.

**Table 1: Descriptive Statistics on Logistics innovation**

Statements	Mean	Std. Dev.
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Our firm uses vehicles and machineries that have low fuel/power consumption	2.75	1.46
Our firm has come up with ways of minimizing gas emissions in its production processes	3.54	1.09
We have embraced technology in monitoring our logistics and truck movements	2.75	1.49
Research and development has been embraced through financing to establish how best we can save on production	2.75	1.58
Training is done frequently on how to embrace green logistics	2.64	1.40
Our production systems are based on new ways established through research	3.11	1.18
We have adopted new designs of our products that are more environmental friendly	3.00	1.22
We adequately involve our suppliers in coming up with products that are aligned to green logistics	2.91	1.28
The designs of our products are based on the set regulations and standards	3.05	1.28

#### 4.3 Descriptive Results on Firm Performance

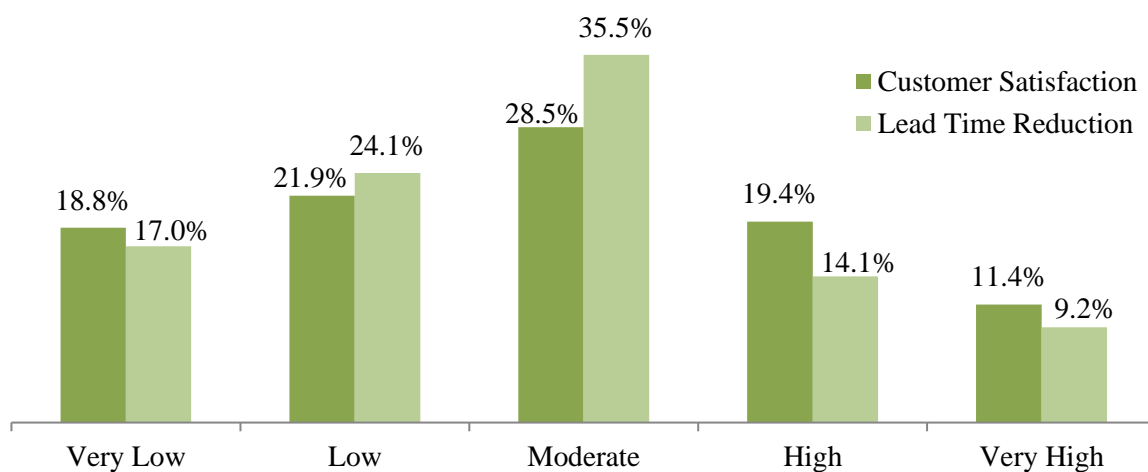
The study sought to find out the opinions of the respondents regarding the performance of their respective organizations. They were asked to indicate their level of agreement or disagreement on specific statements on organizational performance based on a 5-points Likert's scale. The findings are as summarized on Table 2.

**Table 2: Descriptive Statistics on Firm Performance**

Statements	Mean	Std. Dev.
Our company has drastically reduced the rate of customer returns over the past five years	2.68	1.00
The cost of operations in our firm has reduced for the past five years	2.50	1.23
Our company has seen an increase in the sales revenue for the past five years	2.89	1.07

There are fewer customer complaints with regard to our products over the 3.18 1.10 past five years

The study further sought to establish the performance of the building and construction manufacturing firms in terms of lead time and customer satisfaction. As the findings on Figure 2 reveal, lead time reduction was rated at 23.3% while customer satisfaction was rated at 30.8%. This implies that the firms have relatively low customer satisfaction and lead time reduction, despite the two aspects being essential for firm performance and competitiveness.



**Figure 2: Lead-Time Reduction and Customer Satisfaction**

#### 4.4 Correlation Analysis on Logistics innovation and Firm Performance

A correlation between logistics innovation and performance of the building and construction manufacturing firms in Kenya was sought. As the results on Table 3 portray, it was established that the Pearson correlation between logistics innovation and firm performance was 0.762, while the level of significant was  $0.000 < 0.05$ . The results implied that the logistics innovation had a strong correlation with the performance of building and construction manufacturing firms in Kenya.

**Table 3: Correlation between Logistics innovation and Firm Performance**

		Firm Performance	Logistics innovation
Firm Performance	Pearson Correlation	1	.762**
	Sig. (2-tailed)		.000

	N	228	228
	Pearson Correlation	.762**	1
Logistics innovation	Sig. (2-tailed)	.000	
	N	228	228

#### 4.5 Hypotheses Testing

*H<sub>A</sub>: Logistics innovation has a significant effect on the performance of building and construction manufacturing firms in Kenya*

The study sought to assess the influence of logistics innovation on the performance of building and construction manufacturing firms in Kenya. The model summary for the variable is as shown in Table 4. As the results portray, the R<sup>2</sup> for the model is 0.581. This implies that through logistics innovation, there will be a 58.1% variation in the performance of building and construction manufacturing firms in Kenya.

**Table 4: Model Summary on Logistics innovation and Performance**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.762 <sup>a</sup>	.581	.579	.36376

a. Predictors: (Constant), Logistics innovation

The ANOVA results on the logistics innovation and firm performance are as shown in Table 5. As the results portray, the F-statistic for the variable is 313.139 at a significant level of  $0.000 < 0.05$ . This is an implication that the model is statistically significant and it can be used to estimate the relationship between logistics innovation and firm performance.

**Table 5: ANOVA Test Results on Logistics innovation**

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	41.434	1	41.434	313.139	.000 <sup>b</sup>
1	Residual	29.904	226	.132		
	Total	71.338	227			

a. Dependent Variable: Firm Performance

## b. Predictors: (Constant), Logistics innovation

The regression coefficients for the model are as shown in Table 6. As the results portray, the Beta coefficient for logistics innovation was 0.752. This indicates that a unit change in logistics innovation would influence the performance of building and construction manufacturing firms by 0.752 units. The P-value for the model was  $0.000 < 0.05$ , which implies that there is a significant relationship between logistics innovation and performance of the building and construction manufacturing firms in Kenya. To this end, the alternative hypothesis that there is a significant influence of logistics innovation on the performance of building and construction manufacturing firms in Kenya is accepted.

**Table 6: Regression Coefficients on Logistics innovation and Performance**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.772	.132		5.863	.000
1 Logistics innovation	.752	.042	.762	17.696	.000

## a. Dependent Variable: Firm Performance

**4.6 Discussion**

The study sought to establish the effect of logistics innovation on the performance of building and construction manufacturing firms in Kenya. The results revealed that the embrace of vehicles and machineries that had low fuel and low energy consumption was minimal in most of the surveyed firms while most of the firms had embraced ways of minimizing the gas emissions in their production process. Most of the surveyed firms had not embraced technology in monitoring their logistics and truck movements, which could be a factor leading to increased costs and wastage of fuels. One of the major costs that manufacturing firms have to deal with is the cost of fuel, which can be easily dealt with by enhanced use of logistics innovation. The findings however revealed that key innovation practices such as research and development which is meant to enhance the creativity of the employees on how to observe green logistics as well as continuous training on logistics innovation were not effectively upheld by most of the surveyed building and construction manufacturing firms. The findings are supported by the inferential results that revealed that the logistics innovation had a significant and positive impact on the performance of manufacturing firms in the building and construction industry. The results showed that when regressed alone, logistics

innovation had a significant influence on performance, the same case to when it is regressed with the other aspects of green logistics.

## **5.0 CONCLUSION AND RECOMMENDATIONS**

### **5.1 Conclusions**

Logistics innovation is one aspect of green logistics that extensively promotes the performance of building and construction manufacturing firms. The study concludes that the logistics innovation is essential in manufacturing firms in the building and construction sub-sector in that it enhances fuel-saving which is synonymous to cost-saving, while ensuring sustainable logistics practices. The use of solar-technology and bio-fuel has been found to be key aspects of logistics innovation that the building and construction manufacturing firms in Kenya lack, despite these being essential aspects that enhance the performance of the firms. Firm characteristics moderated the relationship between logistics innovation and firm performance. The material sourcing processes as one of the characteristics as well as the supply chain risks determined how effective a firm embraces green logistics for continued performance.

### **5.2 Recommendations of the Study**

Innovation has been an instrumental aspect of every modern-day business operation, including green logistics. Adopting logistics innovation is a process that every organizational management particularly the building and construction manufacturing firms ought to uphold as a way of not only recording superior performance but also promoting sustainability in their logistics processes. It is recommended that the management of the building and construction manufacturing firms spearheads the innovation in green logistics through adoption of fuel-saving strategies, embracing bio-fuels and solar technology. This will ensure that the companies save on the operational costs such as the costs of electricity and fuel, while at the same time conserving the environment by reducing the emissions from fuels and gases.

### **5.3 Recommendations of Areas for Further Study**

The study focused on building and construction manufacturing firms. The building and construction manufacturing industry is a sub-sector of the manufacturing sector in the country. It is therefore recommended that a similar study focuses on other categories of the manufacturing industry, that also would require logistics innovation as an enabler to their continue performance.

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